

Compatibility between Physical Fitness and Work Load among Farm Women

A. Mrunalini

Professor and University Head, Department of Resource Management and Consumer Sciences, Faculty of Home Science, Hyderabad, Professor Jayashankar Telangana State Agricultural University, Andhra Pradesh, India.

Abstract: *The purpose of the study is to examine the physical fitness obtained as per heart rate variable on step stool exercise to heart rate obtained while doing transplantation activity. A field study was undertaken on 20 subjects drawn equally from two age group of farm women i.e., 20-30 yrs and 31-40 yrs. Physical fitness and physiological work load was assessed by using step stool exercise method and when the women were working in transplantation activity using time and heart rate as variables. Results indicated that the subjects were having poor physical fitness and showed vulnerability of the subjects to disease and impairment due to workloads. The transplantation activity warranted above 60% of time spent at and above target zones compared to physical fitness exercise leading to conclude that work load in transplantation is more than the endurance level of physical fitness.*

Keywords: Physical fitness – workload – farm women – transplantation – workload

1. Introduction

Agriculture is one of the important labour intensive activities, wherein maximum percentage of women works. They perform most of the tasks such as transplantation, weeding, harvesting etc, using their manual abilities of strength and fitness. Therefore, physical fitness of women is considered as an essential element for understanding her endurance and sustainability of managing the work loads of farming. The expert committee of the World Health Organization (1981) described physical fitness as “the ability to undertake muscular work satisfactorily.” Physical fitness is the capacity to withstand various forms of physical activities reasonably well, without being unduly tired and is a measure of individual’s health and well-being. The relationship between physical activity and fitness was established by Boucher and Shepherd 1994. ‘Ergonomics’ is a modern management tool applied for ensuring human comfort, safety, effective production and require to gain momentum in its application in the agriculture sector for relieving women’s drudgery. Ergonomists needs to examine the work load and assess the performer’s physical compatibility to work for giving suitable training or technical support. Estimations in this direction are long overdue as these spheres are considered as unorganized sectors with low privileges and lack of concern to the human power involved in it. The present paper examines the work load of women in terms of its demands placed on cardiovascular system. The physical fitness was examined in terms of demands placed on cardio vascular system during step test exercise.

The compatibility or match between work load and fitness was examined as this step is fundamental for assessing the risks associated to work of women in agriculture. The objectives are

- To determine the physical fitness of the selected women by step test exercise
- To study the physiological work load of women in transplantation activity and compare against fitness.

2. Review of Literature

Thune et al. 1998; studied the metabolic profiles among men and women and found that low levels of physical activity and cardio-respiratory fitness were both associated with higher risk of all cause and disease specific mortality.

Lynch B.M et.al. 2011; considered the epidemiologic evidence regarding the association between physical activity and breast cancer risk and found that a 25% average risk reduction amongst physically active women as compared to the least active women. The associations were found strongest for activity sustained over the lifetime or done after menopause, and for activity that is of moderate to vigorous intensity and performed regularly.

A study was carried out in the Dooars region of the Cooch Behar district, West Bengal to evaluate the physical fitness and morphological characteristics due to the physiological workload of respondents engaged in processing of tea leaves in factories within the tea-estates (Sengupta and Sahoo, 2012) and compared to sedentary college students. Results indicated that majority of respondent tea workers had an ectomorph stature but demonstrated good physical fitness level compared to college students. They reflected that the physical activity had shown an influence on the physical fitness status of young tea garden workers.

3. Methodology

A field study was undertaken on 20 women farm workers as subjects drawn equally from two age groups i.e., 20- 30 yrs and 31-40 yrs. All the participants were non pregnant, non smokers and did not report any ill health. The entire step test exercise protocol was explained to them to seek their cooperation and avoid any apprehensions. Transplantation activity among farm works, which was considered as most drudgery prone by the subjects, was selected for cardiac load examination as cardio respiratory fitness is a measure to determine how well a physiological system is capable of transporting oxygen to muscles during prolonged exercise. Physical fitness was determined through step test exercise on

a stepping stool having dimensions (29x45x24 cm), on a four count rhythm till exhaustion or up to a maximum duration of 5 min. immediately after the termination of exercise, the subjects were seated and recovery heart rate was taken after one minute and every minute following that for 3 minutes duration. Physical fitness was calculated using the following formula (Varghese et al., and 1997).

$PFI = \text{Duration of exercise} / (\text{sum of } 1+2+3 \text{ recovery heart rate counts}) \times 100$

The heart rate responses were continuously monitored with the help of "Polar Vantage NVHRM", a heart rate monitor with an interface to the computer. The physiological work load was estimated after obtaining heart rate per every minute for a total period of her activity.

Table 1: Status on physical examination of the subjects according to age

Parameter	Group - 1		Group - 2		t Value
	Mean	SD	Mean	SD	
Height (cms)	151.03	6.36	148.75	6.92	0.76 NS
Gross weight (kgs)	41.45	7.73	40.95	6.01	0.16NS
Lean Body Mass (kg)	30.99	5.67	30.36	4.43	0.27 NS
Oral temperature (F)	97.53	0.53	97.35	1.15	0.44 NS
Pulse Pressure (mm / Hg)	41.4	7.07	38.8	3.7	1.02 NS
VO2 Max (ml / kg / min)	40.6	4.55	31.9	1.73	5.6493*
Body Mass Index	18.07	2.11	18.35	2.35	0.27 NS
Physical Fitness Index	77.31	25.97	73.33	20.03	0.38 NS
Rate of Perceived Exertion	4.6	0.7	4.8	0.42	0.774NS

The mean physical fitness and BMI projected poor physical fitness status and grade-I calorie malnutrition displaying the subject's vulnerability to disease. The step test exercise was perceived as heavy to very heavy by women in both the age groups. When the frequency distribution was examined, as per the body type, 50 per cent of women were belonged to ectomorph and 40 per cent were mesomorph. It projects the lean body stature of the subjects. Only 15 per cent were found to be in normal BMI score and the rest were found to

4. Results

4.1 Physical Fitness Status

The mean values on variables of physical examination viz; height, weight, lean body mass, oral temperature, pulse pressure, Body Mass Index, Physical Fitness Index, vo2 max, Rating on Perceived Index during step test for group 1 and group2 were furnished in Table 1. Data indicated that the subjects were found normal as per oral temperature and pulse pressure with no significant difference between the age groups.

be underweight, or energy deficient. About 75 per cent were in the poor PFI status and 15 per cent were good.

4.2 Workload in transplantation

The work load in transplantation activity in terms of heart rate values, energy values, physiological workloads and environmental conditions was presented in Table 2.

Table 2: Work load in Transplantation as per heart rate

Variable	Group 1 n = 10		Group 2 n = 10		t value
	Mean	SD	Mean	SD	
Resting heart rate b.min ⁻¹	83.46	0.73	82.32	3.66	0.96 NS
Working heart rate b.min ⁻¹	112.46	6.95	114.97	6.99	0.80NS
Cardiac cost of work (beats)	7029.92	1612.93	7938.34	2389.26	0.97NS
Cardiac cost of recovery (beats)	229	153.71	302.66	171	1.01NS
Total cardiac cost of work (beats)	7252.82	1672.08	8241.02	2527.2	1.03NS

An increase in heart rate was observed during the working phase up to 113.72 b.min⁻¹ compared to 82.89 during rest. This shows that cardiac effort has increased by 1.4 times during work over rest. When cardiac cost of work and recovery was observed, it can be noted that work coasted 7484.13 beats per total duration i.e. about 96.6% of cardiac effort work over rest. About 265.83 beats per total duration i.e. 3.4% of cardiac effort was consumed during recovery over rest. This shows that during both work and recovery phases, the load on heart persisted demanding the use of available energy from body. Both groups were found to be

significantly different and Group II was getting more exerted during work. The high standard deviation observed for CCW and TCCW in both the groups indicate that subjects differed among themselves while responding to cardiac load over rest. This may be due to the differences that existed in BMI, PFI.

Table 3 denotes the percentage of time spent by the subjects at different heart rate thresholds for transplantation activity and physical fitness exercise.

Table 3: Percentage of time spent by women at different heart rate thresholds during transplantation activity and physical fitness exercise

Heart rate thresholds	21-30 yrs		31- 40 yrs	
	Percentage of time spent at the HR threshold			
	Transplantation	Physical fitness	Transplantation	Physical fitness
Above max ($>150 \text{ b.min}^{-1}$)	0.6	-	-	-
Above target heart rate threshold ($138 - 150 \text{ b.min}^{-1}$)	7.1	12.5	9.8	-
In target threshold ($107 - 137 \text{ b.min}^{-1}$)	53.6	23.32	63.8	23.8
Below target threshold ($90 - 106 \text{ b.min}^{-1}$)	34.1	9.0	20.9	10.5
Below minimum ($< 90 \text{ b.min}^{-1}$)	4.6	62.42	5.5	65.8

The observations in Table 3 revealed that the subjects of both the age groups spent about 8.45% of time on an average in above the target heart rate threshold during transplantation. A high percentage (58.7%) of time was spent within the target heart rate threshold which is 2.2 times more when compared to the physical fitness exercise. About 27.5% of time was spent below the heart rate threshold in transplantation activity. The data behavior confirmed that the cardiac effort was greater i.e.; about 67 per cent of time when both the target and above target zones were taken together. This is greater when compared to the percent of time in that zone (35%) during physical fitness exercise. Therefore, it can be concluded that the transplantation activity can be considered as strenuous and 'heavy' both by the time spent by women at above target heart rate thresholds and by their perception ratings.

5. Conclusions

The study clearly projected the effect of work on the worker through changes in cardiac responses. Transplantation activity was considered as heavy and demanding as the effort required up to 1.4 times over rest. The heart rate zones during work to physical fitness when observed indicated that transplantation required that women work for about 60 per cent time at and above heart rate thresholds. As 75 % of the workers were found with poor fitness levels, working at higher heart rate thresholds, it can be concluded that there is poor compatibility between work and worker.

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